

MEMORANDUM

TO: Members of the Flood Authority Board

FROM: ESA Adolfson Team

DATE: May 14, 2009

SUBJECT: Recommended Actions and Programs for Draft Plan

We are working on the Recommended Actions and Programs Chapter of the draft Comprehensive Flood Hazard Management Plan. This chapter should be ready for Authority consideration in June. In preparation for that we want to share the outline of the chapter with you, so you can provide direction at the May meeting. The outline divides the recommendations into three categories: major regional capital projects, local capital projects and nonstructural, programmatic actions.

OUTLINE

1. Introduction
2. Criteria and Considerations for Evaluating Projects (attached)
3. Major Regional Capital Projects
 - a. Options
 - b. Studies to support decision-making
 - c. Decision-making strategy flow chart and timeline (attached)
4. Local Capital Projects
 - a. Decision-making process and considerations on capital projects (see attached table of projects)
 - b. Projects to fund
 - c. Projects to support
 - d. Projects to consider in the future
5. Nonstructural Programmatic Actions
 - a. Introduction
 - b. Regulatory programs
 - c. Planning and data collection
 - d. Education and public information
 - e. Governance and management
 - f. Emergency response
 - g. Flood damage reduction
 - h. Natural resource protection
 - i. Forest practices

Work on the above plan recommendations is proposed for both May and June and will be incorporated into this chapter of the draft Plan. We will be looking for Flood Authority guidance as follows:

- Review and revise/accept criteria as considerations to be used in deciding on projects to pursue (May work session)
- Review and revise the decision making flow chart and timeline for major regional capital projects. (May work session)
- Determine if funding should be pursued by the Authority for high priority local capital projects (not the major regional ones) that would likely not move forward in the next two years otherwise, due to lack of funding. If so, agree on criteria for selecting high priority projects to pursue for funding. (May work session)
- Review list of local capital projects to identify those that should be considered further for shorter term funding and support from the Authority (May work session)
- Review and agree on the outline of actions for the nonstructural/programmatic actions category (May work session)
- Consulting Team drafts recommended actions section of the draft Plan and Authority reviews, revises and comments (June work session)

Please review the other draft elements of the recommended actions chapter of the Flood Plan included in this memo:

- Draft Criteria and Regional Projects
- Table of Major Regional Capital Projects*
- Table of Local Capital Projects*
- Table of Nonstructural Programmatic Actions*
- Draft Process for Gathering Information and Making Decisions on Major Regional Projects
- Draft Timeline of Flood Authority and Related Studies and Analyses

*Projects and Programmatic Actions have not been screened and prioritized. Ripe and ready studies that have already been approved by the Authority are not included in these tables.

Draft Criteria and Considerations for Evaluating Projects

The following are proposed for use by the Flood Authority to evaluate potential funding or support of proposed projects.

- **Definition of the Project.** Has the project been sufficiently defined and scoped to be considered and evaluated as a potential project by the Flood Authority?
- **Ability to Meet Goals.** Does the project meet the goals outlined in the Chehalis River Basin Comprehensive Flood Hazard Management Plan?
- **Effectiveness of Mitigation.** What flood hazard problems does the project solve? Is it a permanent or temporary solution? Is it a complete or partial solution?
- **Feasibility.** Are there technical obstacles that would prevent the project being constructed?
- **Cost and Funding Sources.** How expensive is the project and who will bear the cost? Are funding sources available, both in the short-term and long-term?
- **Cost-effectiveness.** How much benefit does the project deliver per dollar invested?
- **Implementing Agency.** Is there an identified agency or jurisdiction who will take the lead on the project?
- **Environmental Impacts.** Does the project have significant environmental impacts or can adverse impacts be mitigated?
- **Permitting Ease.** What approvals or permits will be required? Are those approvals or permits likely to be granted?
- **Timeliness.** How long will it take to implement the project?
- **Acceptability.** Is the project acceptable to the stakeholders in the Chehalis basin?

Major Regional Capital Projects

Project Name	Proposer	Geographic Area	Project Description	Problems Mitigated	Alternatives Examined	Proposed Implementer	Schedule for Implementation	Permit Issues	Estimated Cost	Potential Funding Sources
Twin Cities Project	Corps of Engineers	Centralia and Chehalis, Skookumchuck River, with impacts downstream	A series of levees in Centralia and Chehalis. Potential modifications to the Skookumchuck dam.	Flooding in the Twin Cities and vicinity. Flooding of I-5 near Chehalis.		Corps of Engineers	Design complete in Nov. 2011. Construction begins Oct. 2013, ends in 2020.		Refined cost estimate will be available in January 2010 at 35% design	WRDA bill, Flood Authority state funding authority as local match
Upstream Storage	Lewis County PUD	Upstream on the Chehalis River and South Fork, with benefits downstream	Two dams, one on the Upper Chehalis and one on the South Fork Chehalis.	Flooding downstream of the dams.		Lewis County PUD			\$336 million	Potential for federal funding
Skookumchuck Dam Modifications	TransAlta	Skookumchuck River, with impacts in Chehalis and downstream	Modify the Skookumchuck Dam to allow increased release of water and therefore increased capacity for flood storage	Flooding downstream of the Skookumchuck Dam		TransAlta and Flood Authority				Flood Authority, grants, or the Twin Cities project.
Other Storage Options	Authority	Entire Basin	Examine the potential for flood storage throughout the basin and the potential flood benefits from each.	Reduction in flood peaks downstream of the dams.		Authority or Corps.				Authority or possibly the Corps GI.

Local Capital Projects

Project Name	Proposer	Category	Geographic Area	Project Description	Problems Mitigated	Alternatives Examined	Proposed Implementer	Schedule for Implementation	Permit Issues	Estimated Cost	Potential Funding Sources
Salzer Creek backwater control	Lewis County and Chehalis CFHMP	Floodplain Protection									
Provide increased on-site detention and retention	Grays Harbor County CFHMP	Floodplain Protection									
Build an overtopping levee at the north end of town	Bucoda CFHMP	Floodplain Protection	Within the town of Bucoda								
Install twin 18-inch culverts under Main Street at 11 th	Bucoda CFHMP	Floodplain Protection	Within the town of Bucoda								
Relief Culvert for North Side Runoff	Oakville	Floodplain Protection	Within the city of Oakville	Improve, and lengthen, the drainage system that transports the runoff from the north side of the city in the south side. Install new drainage inlets along near the railroad track and improve the existing system that carries the stormwater to the south side of the city.	Presently this runoff flows east, along the north side of Highway 12, and flows under the Highway just east of the city limits. This runoff eventually overwhelms the Highway ditch and starts flooding the surrounding area. This flooding has occurred more frequent within the last several years and is starting to inundate local roads and damage homes. Installation of this culvert will reroute the runoff to the west side of State Street, which acts like a natural levee, and should reduce the impact of the stormwater flooding on the public.		City of Oakville		Easement for culvert under railroad tracks Easement for crossing of State highway (US12)		
Harris Creek Fish Enhancement	Oakville	Floodplain Protection	Within the city of Oakville	Replace the existing culvert under State Street, at Harris Creek, and replace them with a three-sided structure.	This project would allow for high flows to pass under State Street and reduce the possible of flooding. During the last two winters water has overtopped the roadway in this location cutting off emergency access to a number of residents.	None	City of Oakville & Chehalis Indian Tribe	Summer 2009 or 2010, fish window	Corps of Engineer Permit, HPA, Shoreline exemption	\$330,000, estimate done in 2009	

Project Name	Proposer	Category	Geographic Area	Project Description	Problems Mitigated	Alternatives Examined	Proposed Implementer	Schedule for Implementation	Permit Issues	Estimated Cost	Potential Funding Sources
Sickman-Ford Bridge Culvert	Oakville	Floodplain Protection	Within the City of Oakville	Install four three-sided structures in the northerly approach to the Sickman-Ford Bridge	This project would help reduce the hydraulic gradient that is evident during high water events. This gradient causes severe flooding in both the Black River Basin as well as the Chehalis Basin	None	City of Oakville and Chehalis Indian Tribe	Summer of 2010	Corps of Engineers Permit, HPA, Shoreline exemption	\$624,454, estimate done in 2009	Basin wide flood control
River braiding	Grays Harbor at 2/19 workshop	Floodplain Protection	Wynoochee and Satsop rivers	Open old migration channels							
Culvert projects on Hiram Hill	Grays Harbor at 2/19 workshop	Floodplain Protection	Hiram Hill in Grays Harbor County								
Montesano WWTP	Montesano at 2/19 workshop	Floodplain Protection	Montesano	Raise the height of dikes around, or otherwise protect, the Montesano WWTP							
Adna Levee Improvement	Corps of Engineers	Floodplain Protection	Adna	The Adna levee is a railroad grade that does not currently function as a flood protection levee. This project would improve the railroad grade to provide flood control. To become a flood control structure, the following improvements must be made: A. Determine a public sponsor and acquire easements; B. Add interior drainage; C. Clear the embankment of overgrown vegetation and develop an annual vegetation maintenance program; D. The slope must be repaired to a minimum 2H:1V slope; E. Additional post flood repair work including grading, slope work and crown work Once these improvements have been made, the structure will be eligible for the PL 84-99 program if a sponsor can be found.	The structure is not currently considered a levee. It impounds water on the landward side, and in significant events, overtops and/or breaches, introducing damaging flows to the Adna community. Additional data is required to determine the storm frequency that impounds flow and whether flow is from rain events and/or a result of overbank flow upstream. This railroad grade could potentially be turned into an effective flood control system.		Corps of Engineers				Section 205 could provide a source of funding. The Corps of Engineers needs a nonfederal sponsor to initiate a study under Section 205 and neither the Flood Authority nor Adna qualify. Potential sponsors are the State of Washington or Lewis County. Alternately, the Town of Adna could form a diking district to serve as sponsor.

Project Name	Proposer	Category	Geographic Area	Project Description	Problems Mitigated	Alternatives Examined	Proposed Implementer	Schedule for Implementation	Permit Issues	Estimated Cost	Potential Funding Sources
Develop a technical assistance program for bank stabilization and/or debris removal	Lewis County CFHMP	Bank Protection	Basin-wide.								
Incorporate biostabilization and other engineered solutions to stabilize banks	Grays Harbor County CFHMP	Bank Protection	Basin-wide.								
Provide long-term stabilization of the Wynoochee River banks to protect City sewage facilities	Montesano CFHMP	Bank Protection	Montesano.								
Streambank Stabilization	Bucoda CFHMP	Bank Protection									
Mary's River Lumber bank protection	Montesano at 2/19 workshop	Bank Protection	¼-mile of Chehalis River in Montesano								
Independence Road Bank Protection Project	Thurston County	Bank Protection	Independence Road between Michigan Hill and 201 st Street in Thurston County.	Feasibility Study to realign Independence Road between Michigan Hill Road and south of 201st Street and buy private properties impacted by loss of access. The realignment would be put of the flood plain and the active channel meander zone of the Chehalis River.	The project would eliminate the loss of public access on this section of Independence Road, which is subject to erosion from river channel migration. Also the flooding of adjacent residents would be eliminated if the project included purchase of property and access rights.	The alternative is to continue to address Chehalis River migration and related loss of Independence Road through bank stabilization and required mitigation of associated environmental impacts.	Thurston County Public Works	2015	Many+	\$1 million (very preliminary cost estimate)	?
Open Migration Zone of the Satsop	Grays Harbor at 2/19 workshop	Conveyance Capacity	Satsop River	Remove or mitigate man-made obstacles in the Satsop River							
Dredge Lake Sylvia	Montesano at 2/19 workshop	Conveyance Capacity	Lake Sylvia, behind the (Wynoochee?) dam								

Nonstructural Programmatic Actions

Project Name	Proposer	Category	Geographic Area	Project Description	Problems Mitigated	Alternatives Examined	Proposed Implementer	Schedule for Implementation	Permit Issues	Estimated Cost	Potential Funding Sources
Develop floodplain conservation easement program	Grays Harbor County CFHMP	Regulatory Programs	Basin-wide.								
Improve floodplain and stormwater regulations	Centralia CFHMP	Regulatory Programs	Centralia.								
Tax breaks	Grays Harbor at 2/19 workshop	Regulatory Programs	Entire basin	Give tax breaks to people who remove structures and fill from the floodplain							
Penalization	Chehalis Tribe at 2/19 workshop	Regulatory Programs	Entire basin	Penalize people who build or fill in the floodplain							
Channel Migration Zone Mapping	Lewis County	Planning and Data Collection - Mapping/ Modeling (Local)									
Channel Migration Zone Mapping	Centralia	Planning and Data Collection - Mapping/ Modeling (Local)									
Channel migration analysis	Chehalis Tribe	Planning and Data Collection - Mapping/ Modeling (Local)		Conduct a channel migration analysis for the Chehalis River from the city of Centralia to the Grays Harbor County line							
Comprehensive Flood Plan Augmentation	Chehalis Tribe	Planning and Data Collection - Mapping/ Modeling (Local)		Augment the Chehalis Tribe Comprehensive Flood Plan with 2-, 5-, and 10-year recurrence interval flood surface maps.							
Survey of river cross-sections	Public comment	Planning and Data Collection - Mapping/ Modeling (Regional)									
Remap floodplains	Thurston County	Planning and Data Collection - Mapping/ Modeling (Regional)		Remap floodplains using new 2-foot contour data for all rivers; submit changes to FEMA for map revisions							

Project Name	Proposer	Category	Geographic Area	Project Description	Problems Mitigated	Alternatives Examined	Proposed Implementer	Schedule for Implementation	Permit Issues	Estimated Cost	Potential Funding Sources
Berwick Creek Drainage Plan	Lewis County and Chehalis	Planning and Data Collection - Plans (Local)									
China Creek Drainage Plan	Lewis County and Chehalis	Planning and Data Collection - Plans (Local)									
Rochester Stormwater Plan	Thurston County	Planning and Data Collection - Plans (Local)									
Revise Thurston County's Comprehensive Flood Hazard Management Plan	Thurston County	Planning and Data Collection - Plans (Local)									
Revise Town of Bucoda's Comprehensive Flood Hazard Management Plan	Bucoda	Planning and Data Collection - Plans (Local)									
Reevaluate land uses and zoning based on the new floodplain maps	Thurston County	Planning and Data Collection - Plans (Regional)									
Evaluate channel response to sediment	Chehalis Tribe	Planning and Data Collection - Studies (local)		Evaluate river channel responses to influx and deposition of sediment in the vicinity of the Chehalis Reservation							
Study of failed riprap	Chehalis Tribe	Planning and Data Collection - Studies (local)		Conduct a study to determine volume, placement, and potential impacts of flood on failed riprap placed by Thurston County on the Chehalis River bank adjacent to Independence Road							
Study of proposed mitigation strategies	Chehalis Tribe	Planning and Data Collection - Studies (local)		Identify and conduct studies that would need to be accomplished in order to design the proposed mitigation strategies (such as raising Moon Road)							

Project Name	Proposer	Category	Geographic Area	Project Description	Problems Mitigated	Alternatives Examined	Proposed Implementer	Schedule for Implementation	Permit Issues	Estimated Cost	Potential Funding Sources
Investigate conditions near Wickett levee	Chehalis Tribe	Planning and Data Collection - Studies (local)		Investigate local conditions in the vicinity of the pushup levee near Wickett properties to assess site specific and downstream impacts during flooding							
Study of water backup over HWY 6	Public comment	Planning and Data Collection - Studies (local)		Determine what is causing water backup over Highway 6							
Study of fill adjacent to Harris Creek	Chehalis Tribe	Planning and Data Collection - Studies (local)		Conduct a study to determine the type and volume of fill adjacent to Harris Creek and evaluate if it would be beneficial to remove the fill							
Independence Road Bank Realignment Feasibility Study	Thurston County	Planning and Data Collection - Studies (local)		Feasibility Study – Independence Road Bank Realignment out of Flood Plain							
Skookumchuck River scour potential study	Thurston County	Planning and Data Collection - Studies (local)		Skookumchuck River scour potential with dam modifications							
Dynamic model of middle basin	Chehalis Tribe	Planning and Data Collection - Studies (local)		Coordinate with the Flood Authority to develop a dynamic model of the middle basin to assess effects of future basin development on the flood hydrology at the Chehalis Reservation							
2-D flow model	Chehalis Tribe	Planning and Data Collection - Studies (local)		Construct a two-dimensional flow model for the floodplain with Chehalis Reservation boundaries							
Sickman-Ford Bridge Approach	Chehalis Tribe	Planning and Data Collection - Studies (local)		Model the effects of removing/modifying the Sickman-Ford bridge approach and Balch Road							
Cumulative downstream flood impact analysis	Chehalis Tribe	Planning and Data Collection - Studies (regional)		Conduct a detailed cumulative downstream flood impacts analysis							
Monitoring program on channel conditions and dimensions	Chehalis Tribe	Planning and Data Collection - Studies (regional)		Develop a semi-annual monitoring program focused on documenting changes in Chehalis River channel conditions and dimensions							

Project Name	Proposer	Category	Geographic Area	Project Description	Problems Mitigated	Alternatives Examined	Proposed Implementer	Schedule for Implementation	Permit Issues	Estimated Cost	Potential Funding Sources
Study of impact of recent trucking and warehouse facilities	Public comment	Planning and Data Collection - Studies (regional)		Study the surface water and runoff impact of recent large trucking and warehouse facilities built in the Basin							
Study of groundwater flooding	Public comment	Planning and Data Collection - Studies (regional)		Study how groundwater flooding impacts flood events							
Study groundwater/surface water interaction	Grays Harbor at 2/19 workshop	Planning and Data Collection - Studies (regional)									
Inventory high quality riparian habitat along river reaches	Thurston County	Planning and Data Collection - Studies (regional)									
FloodPath Warning Model	USGS/FEMA	Planning and Data Collection - Studies (regional)									
Floodplain Property Acquisition Program	Lewis County Public Works	Planning and Data Collection - Studies (regional)									
Identification of grant opportunities	ESA Adolfson	Planning and Data Collection - Studies (regional)									
Provide educational materials on flood hazard management	Grays Harbor County CFHMP	Education and Public Information	Basin-wide.								
Provide floodproofing guidance to residents	Grays Harbor County CFHMP	Education and Public Information	Basin-wide.								
Flood Awareness Week	Thurston County	Education and Public Information	Entire basin								
Flood District Formation	Proposed at 2/19 workshop	Governance and Management	Entire basin	Develop a Flood Control District for the entire watershed to plan and implement projects throughout the basin.							
Flood Warning Systems	Lewis County CFHMP	Emergency Response & Preparedness		Evaluate opportunities for flood warning systems							

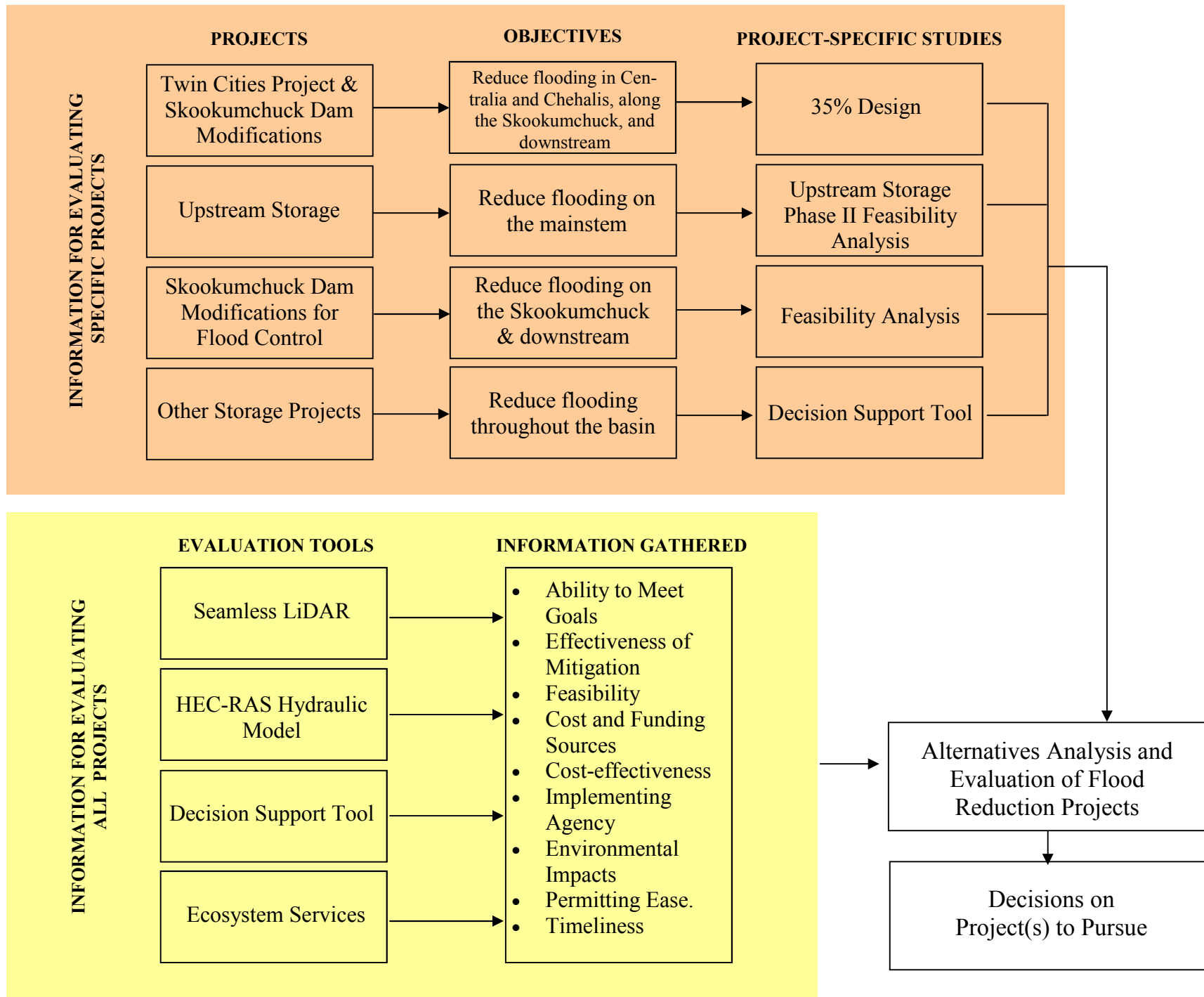
Project Name	Proposer	Category	Geographic Area	Project Description	Problems Mitigated	Alternatives Examined	Proposed Implementer	Schedule for Implementation	Permit Issues	Estimated Cost	Potential Funding Sources
Flood Hazard Warning Policies	Grays Harbor County CFHMP	Emergency Response & Preparedness		Establish policies to ensure that flood hazard warnings are posted during flood events and that flood elevation poles are placed near rivers to show high water marks from previous floods							
Gauges	Grays Harbor County CFHMP	Emergency Response & Preparedness		Install new gauges and upgrade existing gauges. Install flow gauge on Humptulips River. Install stage gauges on the Satsop River, Chehalis River at the Harbor, and Upper Humptulips River							
City Hall Generator	Montesano CFHMP	Emergency Response & Preparedness		Install generator at City Hall for Emergency Operations Center							
Drinking water reservoir	Montesano CFHMP	Emergency Response & Preparedness		Construct drinking water reservoir on city property							
Improve flood notification and response program	Bucoda CFHMP	Emergency Response & Preparedness									
Develop and maintain a specific flood warning and evaluation program for the city	Centralia CFHMP	Emergency Response & Preparedness									
Manage Wynoochee and Skookumchuck dams for flood control	Grays Harbor and TransAlta at 2/19 workshop	Emergency Response & Preparedness	Wynoochee and Skookumchuck dams								
Generator at Grays Harbor Fairgrounds	Grays Harbor at 2/19 workshop	Emergency Response & Preparedness	Grays Harbor Fairgrounds		Grays Harbor Fairgrounds serves as an evacuation site. It typically loses power in flood events.						

Project Name	Proposer	Category	Geographic Area	Project Description	Problems Mitigated	Alternatives Examined	Proposed Implementer	Schedule for Implementation	Permit Issues	Estimated Cost	Potential Funding Sources
Address loss of power and cell phone coverage	Lewis County at 2/19 workshop	Emergency Response & Preparedness	Entire basin								
Critter pads	Lewis County at 2/19 workshop	Emergency Response & Preparedness			Addresses livestock loss						
Join the NFIP Community Rating System	Grays Harbor County CFHMP	Flood Damage Reduction	All communities.		Reduces cost of flood insurance.						
Develop a home elevation and buyout program	Grays Harbor County CFHMP	Flood Damage Reduction	Basin-wide.		Eliminates damages to structures.						
Regrade Main Street	Bucoda CFHMP	Flood Damage Reduction	Bucoda								
Raise houses	Bucoda CFHMP	Flood Damage Reduction	Duplicated.								
Participate in NFIP Community Rating System	Centralia CFHMP	Flood Damage Reduction	Duplicated.								
Moon Road / Easton 188 th Roadway Raise in Elevation	Thurston County	Flood Damage Reduction		Raise the elevation of the lower spots along Moon Road south of State Route 12 and the east end of 188th Ave SW. This project is in the Draft Comprehensive Flood Management Plan for the Confederated Tribes of the Chehalis Reservation. Thurston County's understanding to date (2/20/09) is that the elevation change would be on only the existing lower spots that flood frequently. The raise in elevation would not be like the larger project that was accomplished on parallel Anderson Road. Some form of culverts may also be needed.	Frequent flooding of the most direct access to the easterly end of the Confederated Tribes of the Chehalis Reservation including the Lucky Eagle Casino and motel.	This project is in the Draft Comprehensive Flood Management Plan for the Confederated Tribes of the Chehalis Reservation.	Confederated Tribes of the Chehalis Reservation/Thurston County	Thurston County Six Year Transportation program needs to be amended to include this project. The priority of the county still needs to be established.	SEPA, Shorelines and Tribal Permits	Unknown	Unknown

Project Name	Proposer	Category	Geographic Area	Project Description	Problems Mitigated	Alternatives Examined	Proposed Implementer	Schedule for Implementation	Permit Issues	Estimated Cost	Potential Funding Sources
Elevating homes in the Chehalis Basin	Thurston County	Flood Damage Reduction	Thurston County (potentially Entire basin) Duplicated.	Elevating homes in the Chehalis Basin. This may also include the Skookumchuck and Black River flood plains that are part of the Chehalis Basin.	Flooded private residents and commercial improvements.		Thurston County			Unknown	Unknown
Lincoln Creek Floodplain Purchase	Lewis County	Flood Damage Reduction	Lincoln Creek Road area between Cooks Hill and Matson Roads	Purchase properties to reduce safety impacts, provide floodplain storage, reduce long-term flood related financial impacts to the county, use as wetland banking, avoid the public subsidy of private development, and protect emergency responders from flood related hazards.	Generally, land development in floodplains place obstructions to flood flow paths, which takes a toll on county roads. The impacts to county road maintenance is manifested in the following ways: 1. More frequent repairs of eroding embankments, road surfaces, and culverts. 2. Need to clear and monitor debris from culverts and bridges during heavy storms and high flow events. 3. Upsize culverts and bridges to handle unmitigated, higher flows. 4. Closure and monitor of inundated roadways. Strategic purchase of floodplains will also help the waning of floodwaters, thus allowing access to public roads. Another benefit of this project is emergency response. By keeping passage open, access is provided for emergency vehicles and for evacuation.	The properties have great potential for wetland banking to mitigate for the impacts from new county road construction, and for a countywide recreational trail. Other uses are to lease the properties for seasonal farming or grazing. This project meets all eight goals of Lewis County's CFHMP, which was approved in September 2008.	Lewis County Public Works.	If project is wholly funded, it can begin immediately.	Demolition permits.	\$350,000 for minimal area, and \$500,000 for a larger area.	Chehalis River Basin Flood Authority PW Road Fund

Project Name	Proposer	Category	Geographic Area	Project Description	Problems Mitigated	Alternatives Examined	Proposed Implementer	Schedule for Implementation	Permit Issues	Estimated Cost	Potential Funding Sources
Floodplain Property Acquisition Project	Lewis County	Flood Damage Reduction	Entire basin Duplicated	A project to acquire property in the floodplain. The project would include developed criteria to determine feasibility, priority, and value of potential properties							
Protect and restore critical areas	Centralia CFHMP	Natural Resource Protection									
Provide habitat for wildlife and fish	Centralia CFHMP	Natural Resource Protection									
Camp Creek drainage improvements	Montesano & Grays Harbor at 2/19 workshop	Natural Resource Protection									

DRAFT Process for Gathering Information and Making Decisions on Major Regional Projects



DRAFT TIMELINE OF FLOOD AUTHORITY AND RELATED STUDIES AND ANALYSES June 2009—July 2010

